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The fourth Bent-toed Gecko of the genus *Cyrtodactylus* (Squamata: Gekkonidae) from Java, Indonesia

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Abstract

Cyrtodactylus petani **sp. nov.** is a new species of Bent-toed Gecko from Java, Indonesia that had been masquerading under the name *C. fumosus* (Müller, 1895). The new species is differentiated from *C. fumosus* and all its Sundaland congeners by having the following combination of morphological characters: a maximum SVL of 57.2 mm; nine or ten supralabials; seven or eight infralabials; strongly tuberculate body and limbs; 20–25 paravertebral tubercles; 30–35 ventral scales; enlarged precloacal scales; enlarged femoral scales; 17–18 subdigital lamellae on the fourth toe; 31–35 continuous precloacal and femoral pores in males, pores absent in females; no precloacal groove; no enlarged median subcaudals; tubercles on anterior portion of tail; no reticulated pattern on top of head; a blotched dorsal pattern; and no paired, dark, semi-lunar shaped blotches on the nape.

Key words: *Cyrtodactylus,* new species, Java, taxonomy, Gekkonidae

Introduction

Recently, the number of new species of *Cyrtodactylus* in Southeast Asia has increased as a result of molecular (Johnson *et al.* 2012; Grismer *et al.* 2012a; Grismer *et al.* 2012b; Grismer *et al*. 2014, Riyanto *et al.* 2015) and morphological analyses (Iskandar *et al.* 2011; Riyanto 2012; Pauwels & Sumontha 2014; Pauwels *et al.* 2014; Truong *et al.* 2014) and species on the island of Java have been no exception. Although Schneider *et al.* (2014) stated the primary reason for the high diversity of *Cyrtodactylus* in Southeast Asia is due to their adaptation to limestone habitats there are many other reasons (Grismer 2011).

De Rooij (1915) reported *Cyrtodactylus fumosus* (Müller) and *C. marmoratus* Gray from Java. Brongersma (1934) opined that the characters used to diagnose these species from each other in Java were of no diagnostic value. However, we have observed that these two species in Java differ in that *C. marmoratus* has numerous keeled, conical dorsal tubercles while *C. fumosus* has tubercles that are flat, round, and relatively few in number (type examined). Although Brongersma (1934) believed *C. fumosus* and *C. marmoratus* from Java were conspecific, and that the Javan populations differed from true *C. fumosus* from Sulawesi. In this paper, however, Javan *C. fumosus* is differentiated from *C. marmoratus* and a fourth species of *Cyrtodactylus* is described from East Java that was once considered to be *C. fumosus*.

Material and methods

Color notes were taken from digital images of living specimens prior to preservation. The following measurements from the type series were taken with Mitutoyo dial calipers to the nearest 0.1 mm under a AmScope microscope following Grismer *et al.* (2012b): snout-vent length (SVL), taken from the tip of snout to the vent; tail length

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(TailL), taken from the vent to the tip of the tail, original or regenerated; tail width (TailW), taken at the base of the tail immediately posterior to the postcloacal swelling; forearm length (ForeaL), taken of the dorsal surface from the posterior margin of the elbow while flexed 90° to the base of the heel; tibia length (TibiaL), taken on the ventral surface from the posterior surface of the knee while flexed 90° to the base of the heel; axilla to groin length (AGL), taken from the posterior margin of the forelimb at its insertion point on the body to the anterior margin of the hind limb at its insertion point on the body; head length (HeadL), the distance from the posterior margin of the retroarticular process of the lower jaw to the tip of the snout; head width (HeadW), measured at the angle of the jaws; head depth (HeadD), the maximum height of head from the occiput to the throat; eye diameter (EyeD), the greatest horizontal diameter of the eyeball; eye to ear distance (EyeEar), measured from the anterior edge of the ear opening to the posterior edge of the eyeball; eye to snout distance (EyeS), measured from anteriormost margin of the eye ball to the tip of snout; eye to nostril distance (SnEye), measured between the anterior margin of the eyeball to the posterior margin of the external nares; interorbital distance (InteroD), measured between the anterior edges of the orbit; ear length (EarL), the greatest horizontal distance of the ear opening; and internarial distance (IN), measured between the nares across the rostrum.

Meristic characters follow Grismer (2005): precloacal groove (PG), precloacal pores (PP), femoral pores (FP), femoro-precloacal pores (FPP), enlarged precloacal scales (EPS), enlarged femoral scales (EFS), longitudinal rows of tubercles on dorsum between ventrolateral folds (DT), paravertebral tubercles between midpoint of forelimb insertion and midpoint of hind limb insertion (PVT), and ventral scales across belly between ventrolateral folds (VS). To visualize some structures such as subdigital keels on very small specimens, we applied the reversible stain Methylene Blue in 70% alcohol. For the supralabial and infralabial scales, we counted to the rictus (SuL) and infralabials (InL, including all enlarged scales from mental to rictus). The number of basal subdigital lamellae of manus (SDLM) and pes (SDLP), following Bauer *et al*. (2010) were counted from the most proximal lamella at least twice as large as adjacent palmar scales. We follow Rösler *et. al.*(2007) to counted infrascales, the smooth scales without pores separate the precloacal from the femoral pores or separate the femoro-precloacal pores medially. Measurements and scale counts were made on the right side of each specimen unless otherwise noted. Some of the information on character states and their distribution in other species was obtained from de Rooij (1915), Brongersma (1934), Hikida (1990), Rösler *et al.* (2007), Grismer *et al.* (2007, 2008), Oliver *et al.* (2009), Bauer *et al.* (2010) and Iskandar *et al.* (2011). Sex was determined by the presence or absence of hemipenes, which were everted while injecting the specimen with formalin, or from the presence of eggs in the oviduct. SVL, TailL, and regenerated TailL were measured prior to fixation (fresh) and also after being preserved. Latitude, longitude and altitude of localities of specimens collected were recorded using a Garmin GPS map 60*CSx* using WGS 84 map datum. All specimens (holotype, paratypes and non-types) were deposited in the Museum Zoologicum Bogoriense (MZB), Indonesian Institute of Sciences (LIPI), Cibinong, Bogor, Indonesia. All specimens examined in this paper are listed in Appendix 1.

Phylogenetic analysis. We obtained sequence data from a 1473 bp fragment of the mitochondrial gene NADH dehydrogenase subunit 2 gene (ND2) including the flanking tRNAs (trna *WANCY*) from two ingroup samples. Based on relationships of Wood *et al.* (2012), 10 other species of *Cyrtodactylus* were used as an outgroup.

Genomic DNA was isolated from liver or skeletal muscle samples stored in 95% ethanol using the Qiagen DNeasy™ tissue kit (Valencia, CA, USA). ND2 was amplified using a double-stranded Polymerase Chain Reaction (PCR) under the following conditions: 1.0 µl genomic DNA, 1.0 µl light strand primer 1.0 µl heavy strand primer, 1.0 µl dinucleotide pairs, 2.0 µl 5x buffer, MgCl 10x buffer, 0.1 µl Taq polymerase, and 7.56 µl ultra-pure H_2O. PCR reactions were executed on an Eppendorf Mastercycler gradient theromocycler under the following conditions: initial denaturation at 95°C for 2 min, followed by a second denaturation at 95°C for 35 s, annealing at 48°C for 35 s, followed by a cycle extension at 72°C for 35 s, for 31 cycles. All PCR products were visualized on a 1 % agarose gel electrophoresis. Successful PCR products were vacuum purified using MANU 30 PCR plates (Millipore) and purified products were resuspended in ultra-pure water. Purified PCR products were sequenced using the ABI Big-Dye Terminator v3.1 Cycle Sequencing Kit in an ABI GeneAmp PCR 9700 thermal cycler. Cycle sequencing reactions were purified with Sephadex G-50 Fine (GE Healthcare) and sequenced on an ABI 3730xl DNA Analyzer at the BYU DNA Sequencing center. Primers used for amplification and sequencing are presented in Table 1. Sequences were analyzed from both the 3' and the 5' ends separately to confirm congruence between the reads. Both the forward and the reverse sequences were uploaded and edited in Geneious™ version v5.5.6 (Drummond *et al.* 2011) and were edited therein. The protein-coding region of the ND2 sequence was

aligned by eye. MacClade v4.08 (Maddison & Maddison 2005) was used to calculate the correct amino acid reading frame and to confirm the lack of premature stop codons. All specimens used in this study are presented with GenBank accession numbers in Appendix 2.

TABLE 1. Primer sequences used in this study for the ND2 gene.

Primer name	Primer reference		Sequence
L4437b	(Macey & Schulte, 1999)	External	5'-AAGCAGTTGGGCCCATACC-3'
CyrtintF1	(Siler *et al.*, 2010)	Internal	5'-TAGCCYTCTCYTCYATYGCCC-3'
CyrtintR1	(Siler *et al.*, 2010)	Internal	5'-ATTGTKAGDGTRGCYAGGSTKGG-3'
H5934	(Macey & Schulte, 1999)	External	5'-AGRGTGCCAATGTCTTTGTGRTT-3'

For the phylogenetic analyses we applied two model-based methods, Maximum Likelihood (ML) and Bayesian Inference (BI). The Akaike Information Criterion (AIC) as implemented in ModelTest v3.7 (Posada & Crandall 1998), was used to calculate the best-fit model of evolution for each codon position (*see* Grismer *et al.* 2014, Table 3). Maximum Likelihood analysis was performed using RAxML HPC v7.5.4 (Stamatakis *et al.* 2008), 1000 bootstrap pseudoreplicates via the rapid hill-climbing algorithm (Stamatakis *et al.* 2008). Nodes that had bootstrap values (ML) above 70 were considered significantly supported. The Bayesian analysis was carried out in MrBayes v3.2 (Ronquist *et al.* 2012). Two simultaneous runs were performed with eight chains per run, seven hot and one cold following default priors. The analysis was run for 5,000,000 generations and sampled every 500 generations from the Markov Chain Monte Carlo (MCMC). The analysis was halted after the average standard deviation split frequency was below 0.01. Conservatively the first 25% of the trees from each run were discarded as burnin. A consensus tree was then computed from the two parallel runs using MrBayes v3.2 (Ronquist *et al.* 2012). Nodes that had posterior probabilities (BBP) above 0.95 were considered significantly supported (Wilcox *et al.* 2002).

Results

The molecular analyses indicate that the East Javan population is a unique lineage and sister species to *Cyrtodactylus batucolus* Grismer, Chan, Grismer, Wood & Belabut from Pulau Besar, Peninsular Malaysia (Fig. 1). The morphological data also indicate the East Javan population is easily separated from all other species of *Cyrtodactylus* from Sundaland (Table 3). Given the results of these analyses, we describe this population as a new species.

Systematics

***Cyrtodactylus petani* sp. nov.**
(Cicak Jari Lengkung Petani: Farmer's Bent-toed Gecko)
Figs. 2–4.

Holotype. MZB.Lace.12899 (Field number AR5507), adult male, Purwodadi Botanical Garden, Purwodadi Village, Purwodadi Subdistrict, Pasuruan District, East Java Province, Indonesia (07º47'58.73" S; 112º44'13.73" E; 325 m asl), collected 18 October 2006 by Awal Riyanto and Mulyadi.

Paratype. MZB.Lace.11706, 11707, 11708, 11709, 11710, 11711, 11712, 11713, 11714, 11715, adult males, Jeladri Village, Winangon Subdistrict, Pasuruan District, East Java Province, Indonesia (07º46'15.8" S; 112º58'00.5" E; 129 m asl), collected 4 March 2014 by Awal Riyanto; MZB.Lace.12143, adult male, Mliwang Village, Kerek Subdistrict, Tuban District, East Java Province, Indonesia (06°49'59.4"S, 111°51'59.8"E; 86 m asl) collected by Awal Riyanto and Wahyu Trilaksono; MZB.Lace.12898, an adult male, Porong River, Sidoarjo City, East Java Province, Indonesia (7°26'48.37"S; 112°28'08.70"E), collected 17 October 2006 by Awal Riyanto and Mulyadi; MZB.Lace.12900, adult male, Purwodadi Botanical Garden, Purwodadi Village, Pasuruan District, East Java Province, Indonesia (7°47'58"S; 112°44'13"E; 325 m asl), collected 18 October 2006 by Awal Riyanto and Mulyadi.

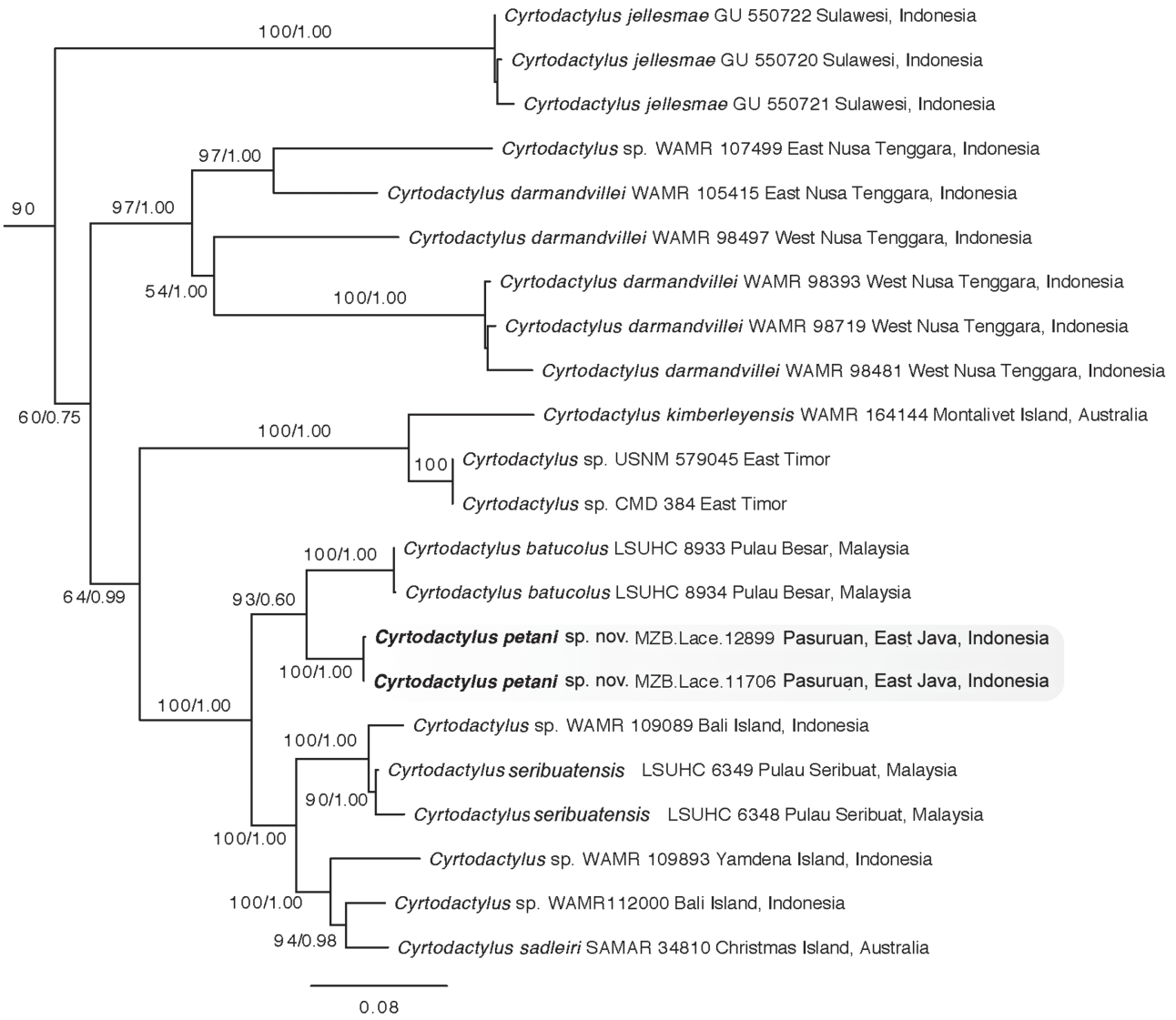

FIGURE 1. Inferred phylogenetic relationships of *C. petani* **sp. nov.** The tree is a Maximum likelihood topology (-ln L 13731.665952) with Bayesian Posterior probabilities and Maximum Likelihood bootstrap values respectively.

Diagnosis. *Cyrtodactylus petani* **sp. nov.** is distinguished from all Javan and Sundaic species by having a maximum SVL up to 57.2 mm; nine or 10 supralabials; seven or eight infralabials; strongly tuberculated body and limbs; 20–25 paravertebral tubercles; 30–35 ventral scales; enlarged femoral scales; enlarged precloacal scales; 17–18 subdigital lamellae on the fourth toe; 31–35 continuous precloacal and femoral pores in males, pores absent in females; precloacal groove absent, no enlarged median subcaudals; tubercles on anterior portion of tail; no reticulated pattern on head; paired dark blotches forming a V-shaped on occiput; blotched dorsal pattern; and no paired, dark, semi-lunar-shaped blotches on upper nape.

Description of holotype. Adult male, SVL 57.2 mm, TailL 81.2 mm; head triangular, moderately long (HeadL/SVL 0.28) and wide (HeadW/HeadL 0.68), somewhat depressed (HeadH/HeadL 0.40), distinct from neck; lores weakly inflated, prefrontal region concave, canthus rostralis smoothly rounded; snout short (SnEye/HeadL 0.36) and rounded; eye large (EyeD/HeadL 0.24); ear opening oblong, small (EarL/HeadL 0.09); eye to ear distance greater than diameter of eye (EyeEar/EyeD 1.26); rostral 2.6 times wider (2.9 mm) than deep (1.1 mm), incompletely divided dorsally by a median Y-shaped rostral groove, bordered posterodorsally by four granules of which three are large; nostril bordered anteriorly by rostral, dorsally by one anterior supranasal, posteriorly by three nasals, and ventrally by first supralabial; nine supralabial scales to rictus on right and nine supralabial scales on left sides; eight infralabial scales on left and right, first three largest; scales of rostrum, lores, crown, and occiput small and granular, occiput with few small tubercles; mental triangular, as wide (2.4 mm) as deep (1.9 mm),

bordered laterally by first infralabial and posteriorly by paired elongate postmentals in contact medially for 60% of their length (Figure 3A); gular scales small and granular, grading posteriorly into slightly larger, flatter, throat scales, then into large, flat, imbricate pectoral and abdominal scales.

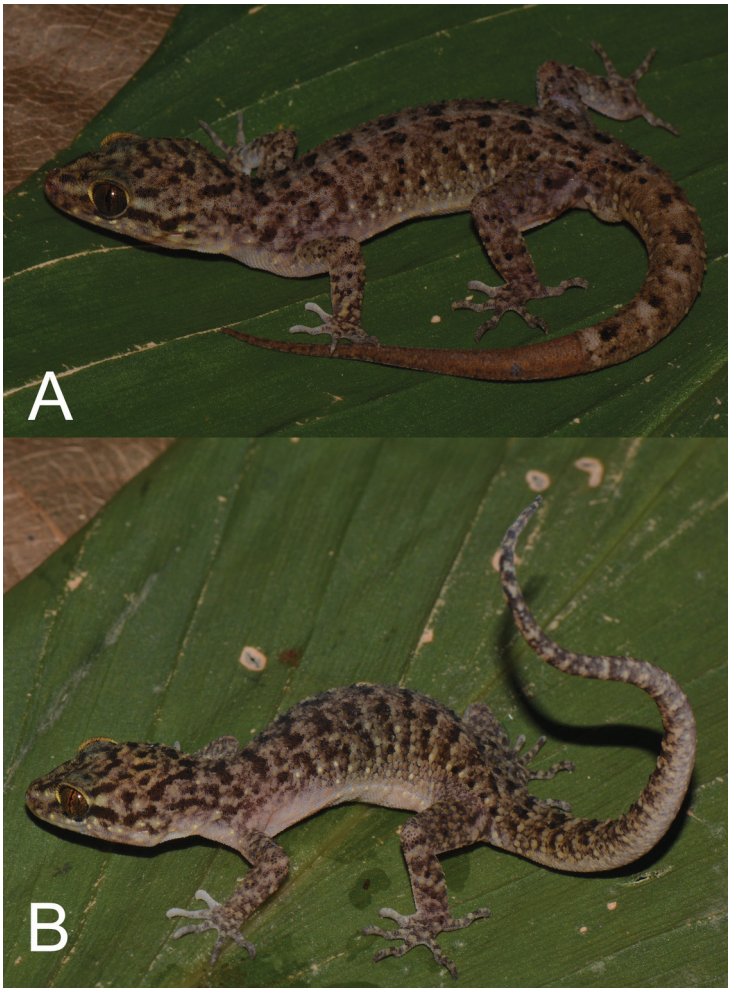

FIGURE 2. Living specimens of *Cyrtodactylus petani* **sp. nov.** from Jeladri, Pasuruan, Java. (A) Adult male paratype MZB.Lace 11712 (SVL=56.6 mm). (B) Gravid female paratype MZB.Lace 11711. (SVL=53.8 mm).

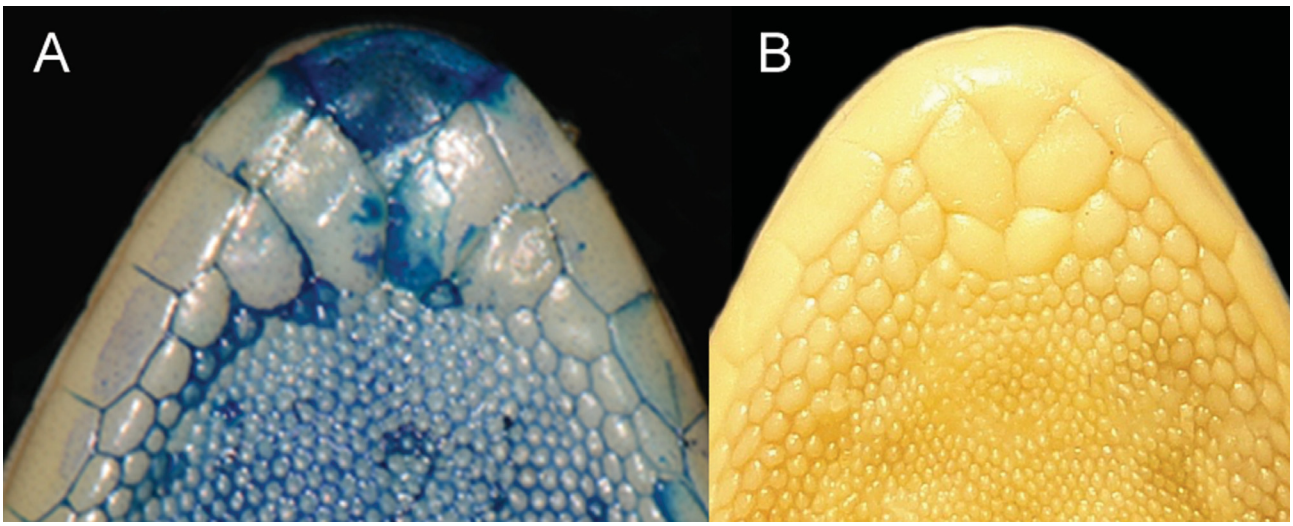

Figure 3. Comparison of mental region between *Cyrtodactylus petani* **sp. nov.** and *C. marmoratus* (A) Mental view of holotype *Cyrtodactylus petani* **sp. nov.**, MZB.Lace.12899, (B) Mental view of lectotype *Cyrtodactylus marmoratus*, RMNH 2710A (photo courtesy of Hinrich Kaiser).

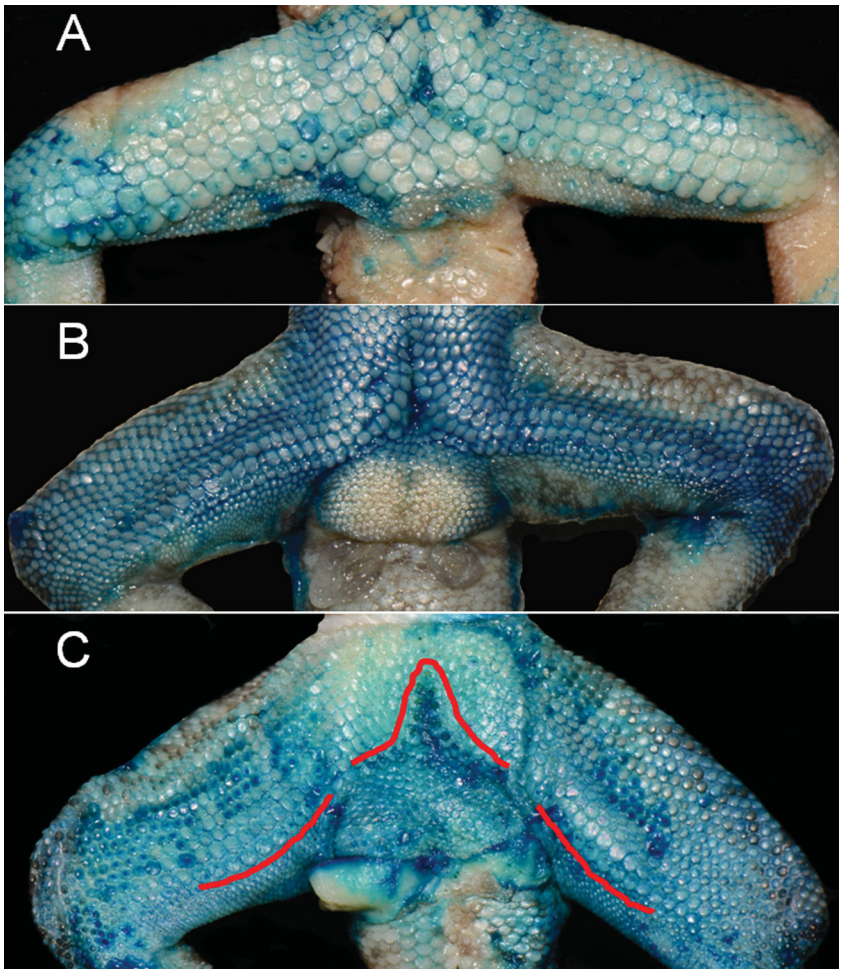

FIGURE 4. Comparison of precloacal and femoral regions between the new species and other Javan species.(A) Holotype *Cyrtodactylus petani* **sp. nov,** MZB.Lace.12899, (B) *Cyrtodactylus fumosus*, MZB.Lace 12903, from mount Talaga Bodas, West Java, and (C) *Cyrtodactylus marmoratus*, MZB.Lace 12139) from mount Selamet, Central Java. Specimens have been stained to accentuate scale borders and pores.

Body relatively short (AGL/SVL ratio 0.47) with weak ventrolateral folds bearing tubercles; dorsal scales small and granular, interspersed with relatively high, trihedral, rounded, irregularly arranged tubercles with 19 longitudinal rows at midbody; 35 flat, imbricate ventral scales between indistinct ventrolateral body folds; ventral scales larger than dorsal scales. Forelimbs short (ForeaL/SVL 0.13); granular scales of forearms similar those of body; a few tubercles on dorsum of arm base; palmar scales slightly raised, smaller anteriorly than posteriorly; digits short, with inflection at basal interphalangeal joints; subdigital lamellae transversely expanded proximal to joint inflections, digits narrow distal to joints; claws well-developed, sheathed by a dorsal and ventral scale; subdigital lamellae on digits of manus: I(13), II(15), III(16), IV(15), V(13), relative lengths of manual digits: IV>V>III>II>I.

Hind limbs more robust than forelimbs, tibia relatively short (TBL/SVL 0.17), covered dorsally with granular scales interspersed with tubercles; ventral hind limb scales flat, larger than dorsals; enlarged precloacal scales present; enlarged femoral scales present in two series, posterior series largest and grading anteriorly into slightly smaller anterior series and then into granular subfemoral scales (Figure 4A); precloacal groove absent but a slight depression present; 35 precloaco-femoral pores in Λ-shape; digits short, subdigital lamellae of pes transversely expanded proximal to inflected joints, digits narrow distal to joints; number of subdigital lamellae on pes: I(12), II(15), III(17), IV(18), V(15), relative length of pedal digits: IV>V>III>II>I; claws well-developed, sheathed by a dorsal and ventral scale.

Tail original, TailL/SVL 1.42, robust at base, tapering to terminus; dorsal caudal scales granular with six small tubercles on anterior caudal whorls; two post-cloacal spurs on each side of vent; subcaudals small, flat, imbricate, smooth, and rounded, lacking enlarged median subcaudals.

TABLE 2. Morphometric and meristic characteristics of *Cyrtodactrytlus petani* **sp. nov**

	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Non type	Holotype	Non type
MZB.Lace.	11706	11707	11708	11709	11710	11711	11712	11713	12143	12898	12899	12900
Field number	NA 12	NA 13	NA 14	NA 15	NA 16	NA 17	NA 05	NA 06	A050	AR5506	AR5507	AR5508
Collecting date	6 March 2014	6 March 2014	6 March 2014	6 March 2014	6 March 2014	6 March 2014	4 March 2014	5 March 2014	4 October 2012	18 October 2006	18 October 2006	18 October 2006
Sex	Male	Male	Male	Male	Male	Female (gravid)	Male	Male	Male	Male	Male	Male
Supralabials	10	9	10	10	10	10	10	10	10	10	9	10
Infralabials	8	7	7	8	8	8	8	8	7	8	8	8
DT	18	19	18	18	19	18	18	18	18	17	19	19
PVT	20	20	25	24	20	24	24	24	25	20	20	25
VS	34	33	32	35	33	34	34	32	30	34	35	34
Post cloacal tubercles	2	2	2	2	2	3	3	2	3	2	3	2
Lamella (manus)	12-13-15-13-13	10-12-14-13-13	10-12-14-14-13	10-13-16-15-12	12-12-13-14-14	11-12-15-15-13	12-13-14-15-13	11-14-14-14-12	12-12-15-15-14	11-13-15-15-14	13-15-16-15-13	12-13-16-15-14
Lamella (pes)	13-13-16-18-18	12-14-15-17-17	12-13-14-17-17	12-14-16-18-18	13-14-15-18-17	12-14-16-18-16	12-14-16-18-18	13-14-14--18-18	13-14-16-18-17	12-14-17-18-16	12-14-17-18-17	12-15-18-18-15
Femoro-precloacal pores	35	31	33	35	35	0	31	33	33	33	35	33
SVL	50.5	53.8	54.5	55.0	49.9	53.8	56.6	45.0	51.1	49.7	57.2	51.7
TailL	66.2	55.6 (regen)	59.6 (regen)	64.5 (broken)	55.4 (regen)	68.0	65.8 (regen)	50.0 (regen)	66.0 (regen)	69.2 (regen)	81.2	36.3 (broken)
TailW	5.5	5.4	6.5	6.2	5.4	5.1	6.2	4.5	5.4	5.1	5.6	4.5
ForeaL	6.9	7.5	8.1	7.9	7.3	7.6	8.0	6.7	7.7	7.8	8.5	5.8
TibiaL	9.4	9.5	10.5	9.7	9.0	9.6	11.0	7.9	9.7	9.7	9.7	9.2
AGL	20.4	24.0	23.8	24.4	18.3	23.5	24.4	19.0	23.2	21.9	26.2	20.9
HeadL	14.4	15.4	17.1	18.8	15.3	16.0	16.9	14.0	15.8	14.0	16	14.7
HeadW	9.8	10.3	11.4	11.2		10.6	11.0	8.9	10.1	9.3	10.8	10.0
HeadD	6.1	6.3	7.2	6.9	6.1	6.3	6.7	5.2	6.8	5.9	6.4	6.0
EyeD	3.6	4.0	4.2	3.8	3.2	3.4	4.2	2.9	4.0	4.1	3.9	4.0
EyeEar	4.0	4.0	4.6	4.8	3.9	4.2	4.8	3.9	4.5	3.8	4.9	4.3
Eyes	5.5	6.1	6.3	6.2	5.4	6.0	5.9	5.0	5.7	6.0	5.7	5.3
EN	4.2	4.3	4.6	4.9	4.3	3.6	4.3	3.6	4.4	4.0	4.6	4.1
InteroD	4.2	4.7	5.0	4.3	4.1	4.6	4.6	3.4	3.8	4.7	4.7	4.1
EarL	1.5	1.4	1.5	2.0	1.4	1.4	2.0	1.8	1.9	1.5	1.5	1.5
IN	2.2	2.0	1.7	2.1	1.7	1.9	2.0	1.5	1.6	2.0	1.8	1.5

TABLE 3. Comparison of selected mensural and meristic features between *Cyrtodactylus petani* **sp. nov.** and other known Javan congeners based on male specimens.

	petani **sp. nov**	*fumosus*	*marmoratus*	*semiadii*
Sources	n=11	n=2	n=5 (Rösler *et al*. 2007)	n=3
Max SVL	57.2	75.2	80.5	47.1
Tuberculation moderate to strong	yes	yes	yes	no
Tuberculation on forelimbs	yes	yes	no	no
Tuberculation on hind limbs	yes	yes	yes	no
Tuberculation on head/or occiput	yes	yes	yes	no
Paravertebral tubercles	20-25	30-33	30-34	37-40
Ventral scales	30–35	35-40	35-40	36
Proximal subdigital lamellae broad	yes	yes	yes	yes
Subdigital lamellae under 4th toe	17–18	22	20–24	14–15
Precloacal groove	no	yes	no	no
Enlarged precloacal scales	yes	yes	yes	no
Enlarged femoral scales	yes	yes	yes	no
Precloacal and femoral pores continuous	yes	yes	no	no
Precloaco-femoral pores	31–35	46–50	45–50 (continuous); or 14–17 precloacal pores separated by 2–7 poreless scales from 5–16 (right) and 4–15 (left) femoral pores (discontinuous)	no
Enlarge median subcaudals	no	no	no	no
Reticulated pattern on head	no	no	no	no
Body banded, blotched or stripped	blotched	blotched	blotched	blotched
Tuberculation on ventrolateral folds	yes	yes	no	yes

Coloration in life. Top of head lacking a dark reticulate pattern; lateral portion of head bearing a dark line extending from nostril, passing through eye and terminating on upper ear; ventrolateral region of head bearing yellowish spots; upper labial scales lighter brown with some yellow and black spots, lower labial scales not as dark as the upper labial scales only with some yellow spots; body dorsum light-brown, bearing small yellowish spots mixed with dark-brown tubercles; seven black, paired blotches between axilla and groin; venter white, border of some scales yellowish; dorsal part of limbs light-brown mixed between black and yellowish tubercles, ventral part of limbs white, some scales with yellowish border; ventrolateral and ventral portion of tail yellowish.

Variation. Males have precloaco-femoral pores and a precloacal groove, whereas females do not. Detailed variation of mensural and meristic characters of are presented in Table 2.

Etymology. The specific epithet *petani* refers to the fact that the type series was collected on a farm. *Petani* means a farmer in the Indonesian Language and is here treated as a noun in apposition.

Comparison. *Cyrtodactylus petani* **sp.nov.** differs from its sister species *C. batucolus* Grismer, Chan, Grismer, Wood & Belabut, 2008 by having fewer precloaco-femoral pores (31–35 *versus* 43–46) and a smaller maximum SVL (57.2 mm *versus* 75.2 mm). *Cyrtodactylus petani* **sp. nov.** differs from *C. seribuatensis* Grismer & Youmans, 2006 in having fewer precloaco-femoral pores (31–35 *versus* 40–43) and a smaller maximum SVL (57.2 mm *versus* 75 mm). The new species is distinguished from *C. fumosus* by lacking a precloacal groove, having fewer paravertebral tubercles (20–25 *versus* 30–33), fewer subdigital lamellae under the fourth toe (17–18 *versus* 22), fewer precloaco-femoral pores (31–35 *versus* 46–50) and a smaller maximum SVL (57.2 mm *versus* 75.2 mm). From *C. marmoratus sensu stricto* (lectotypes; see Rösler *et al.* 2007) it can differentiated by having tubercles in the ventrolateral body fold, fewer ventral scales (30–35 *versus* 38–47), fewer precloaco-femoral pores (31–35 *versus* 45–50) and fewer subdigital lamellae under the fourth toe (17–18 *versus* 20–24 lamellae). It can be differentiated from *C. semiadii* Riyanto, Bauer & Yudha, 2010 by having tuberculation on both forelimbs and hind limbs, presence of precloaco-femoral scales and fewer paravertebral tubercles (20–25 *versus* 37–40).

Distribution and natural history. *Cyrtodactylus petani* **sp. nov.** is known only from East Java (Fig.5). The type series was collected from a variety of habitats, i.e. paddy field embankments, rocks in a farm garden, rocks on the riverbank, trees on the border of a farm garden, and teak forests (Fig. 6). All were found no more than 40 cm above the ground. MZB.Lace.12898 was collected along the edge of Porong River on a cement bank. MZB.Lace.12899 and 12900 were collected on the edges drains in the Purwodadi Botanical Garden between 1730 and 2100 h while foraging. This indicates that this species lives in variety of habitats, including modified environments, especially agricultural areas.

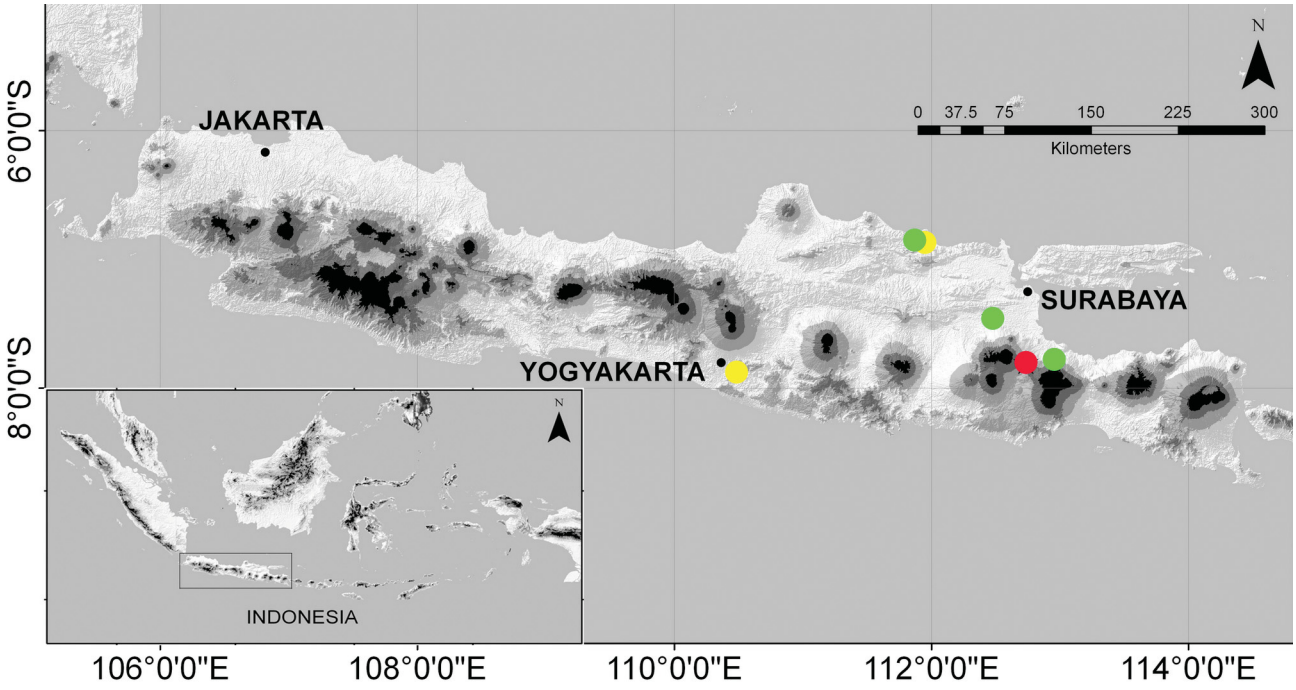

FIGURE 5. Distribution map of Javan *Cyrtodactylus*. Red circle is holotype of *Cyrtodactylus petani* **sp. nov.** Green circles are paratype localities of *C. petani*.Yellow circles are known localities of *C. semiadii*. The distribution of the widespread species, *C. marmoratus* and *C. fumosus* are not shown.

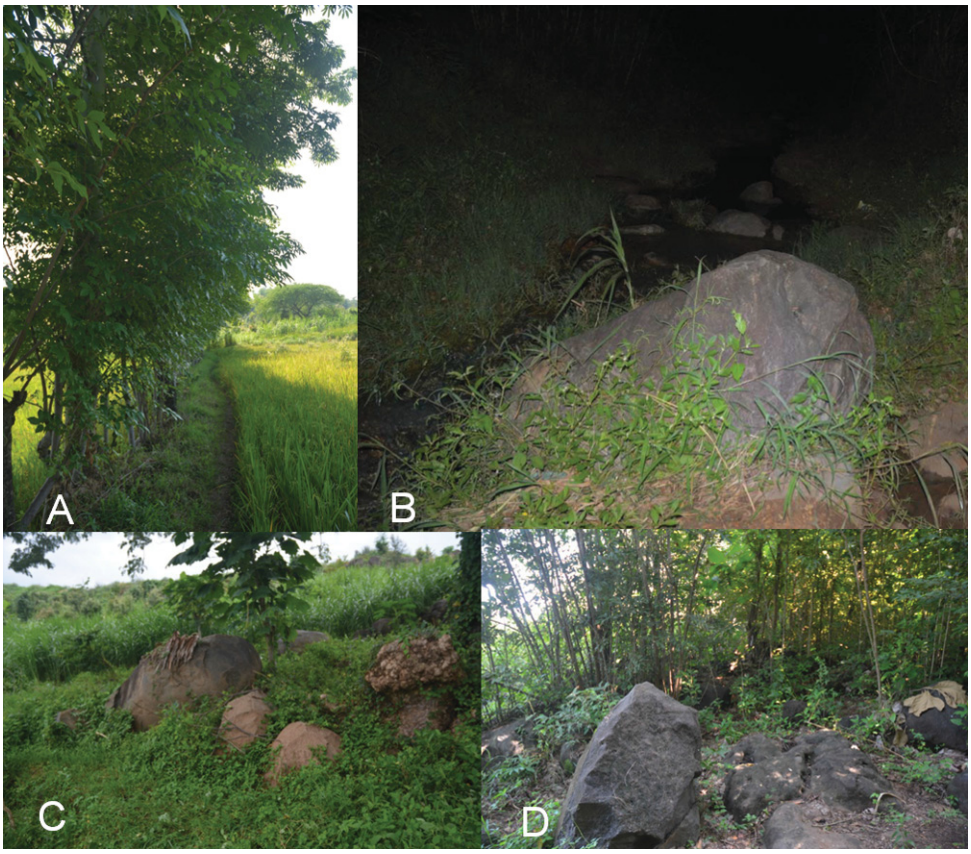

FIGURE 6. Microhabitats where specimens of *Cyrtodactylus petani* **sp. nov.** were collected. (A) paddy field embankment with vegetation. (B) Rocks in the riverbank. (C) Rocks in the farm garden. (D) Rocks in the teak forest.

Discussion

Cyrtodactylus petani **sp. nov.** is the fourth species of *Cyrtodactylus* from Java that was not reported in previous herpetofaunal surveys of East Java. As suggested by Riyanto *et al.* (2014), *C. fumosus* from Java includes multiple undescribed species. Together, with other recent findings, including the discovery of a new *Cyrtodactylus* (Riyanto *et al.* 2014), a new *Chiromanthis* (Riyanto & Kurniati, 2014), a new *Eutropis* (Mausfeld & Böhme 2002), a suspected new species of *Ptychozoon* (Brown *et al.* 2012), a new record for *Polypedates otilophus* (Riyanto *et al.* 2009), and a relatively new *Dendrelaphis* (Rooijen & Vogel 2008), this discovery suggests much is yet to be learned concerning the herpetofaunal composition of Java. This discovery also indicates that the diversity of *Cyrtodactylus* continues to rise even in highly disturbed areas.

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APPENDIX 1. Comparative material examined.

Cyrtodactylus fumosus: MZB.Lace.12903, 12904, adult males, Mount Talaga Bodas, West Java, Indonesia.
Cyrtodactylus marmoratus: MZB.Lace.12902, 12905 and 12907, adult males, Mount Talaga Bodas, West Java; MZB.Lace.12924, adult males, Mount Ciremai, West Java; MZB.Lace.12912, 12913, adult males, Mount Selamet, Central Java.
Cyrtodactylus semiadii: MZB.Lace.9104 (holotype), 9105-06 (paratype), Tuban, East Java, Indonesia.

APPENDIX 2. Species used in the molecular study with locality information and GenBank accession numbers. Museum acronyms are as follows: CMD, USNM field number; (see below for USNM); LUHC, La Sierra University Herpetological Collection; MZB, Museum Zoologicum Bogoriense; RMB, Rafe M. Brown personal collection; USNM, United States National Museum (Smithsonian); SAMAR, South Australian Museum, Adelaide; WAMR, Western Australian Museum.

Voucher	Genus and Species	Locality	GenBank Accession #
LSUHC 8933	*Cyrtodactylus batucolus*	Pulau Besar, Malaysia	JQ889178
LSUHC 8934	*Cyrtodactylus batucolus*	Pulau Besar, Malaysia	JQ889179
WAMR 105415	*Cyrtodactylus darmandvillei*	East Nusa Tenggara, Indonesia	KU232615
WAMR 98497	*Cyrtodactylus darmandvillei*	East Nusa Tenggara, Indonesia	KU232616
WAMR 98481	*Cyrtodactylus darmandvillei*	West Nusa Tenggara, Indonesia	KU232617
WAMR 98393	*Cyrtodactylus darmandvillei*	West Nusa Tenggara, Indonesia	JX440533
WAMR 98719	*Cyrtodactylus darmandvillei*	West Nusa Tenggara, Indonesia	KU232618
RMB 1692	*Cyrtodactylus jellesmae*	Sulawesi, Indonesia	GU550720
RMB 1672	*Cyrtodactylus jellesmae*	Sulawesi, Indonesia	GU550721
RMB 1685	*Cyrtodactylus jellesmae*	Sulawesi, Indonesia	GU550722
WAMR164144	*Cyrtodactylus kimberleyensis*	Montalivey Island, Australia	JX440544
MZB.Lace. 12899	*Cyrtodactylus petani* sp. nov.	Pasuruan, East Java, Indonesia	KU232619
MZB.Lace. 11706	*Cyrtodactylus petani* sp. nov.	Pasuruan, East Java, Indonesia	KU232620
LSUHC 6618	*Cyrtodactylus quadrivirgatus*	Genting Highlands, Malaysia	JQ889221
SAMAR 34810	*Cyrtodactylus sadleiri*	Christmas Island, Australia	JQ820309
LSUHC 6348	*Cyrtodactylus seribuatensis*	Pulau Seribuat, Malaysia	JX440557
LSUHC 6349	*Cyrtodactylus seribuatensis*	Pulau Seribuat, Malaysia	JQ889187
WAMR109893	*Cyrtodactylus* sp.	Yamdena Island, Indonesia	KU232621
CMD 384	*Cyrtodactylus* sp.	East Timor	KU232622
USNM 579045	*Cyrtodactylus* sp.	East Timor	JX440560
WAMR 107499	*Cyrtodactylus* sp.	East Nusa Tenggara, Indonesia	KU232623
WAMR 112000	*Cyrtodactylus* sp.	Bali Island, Indonesia	KU232624
WAMR 109089	*Cyrtodactylus* sp.	Bali Island, Indonesia	KU232625